

**REMARKS**

Claims 1, 5 and 9 stand rejected under 35 U.S.C. § 103 as being unpatentable over Endo et al. '804 ("Endo") in view of Leveriza et al. '247 ("Leveriza"), and claims 3, 7 and 11 stand rejected under 35 U.S.C. § 103 as being unpatentable over Endo in view of Leveriza and Harada et al. '776 (Harada et al. relied on only for allegedly disclosing "processing chambers and transportation between processing chambers"). Claims 1, 3, 5, 7, 9 and 11 are independent. These rejections are respectfully traversed for the following reasons.

Claims 1, 3, 5, 7, 9 and 11 each embody in part pre-baking the resist film in a vacuum and exposing the pre-baked resist film to extreme ultraviolet radiation (EUV). It is respectfully submitted that this *combination* can provide a new and unexpected result, thereby improving prior art methods. Applicant has discovered that when using short-wavelength radiation (e.g., EUV) in a conventional exposure step, the walls of the patterned film are formed with a high-degree of roughness. As described, for example, on page 3, line 8 – page 4, line 19 of the specification, Applicant researched the cause of the roughened surface when using short-wavelength radiation like EUV and discovered that the high energy exposure of such radiation can lead to a release of gas (e.g., CO<sub>2</sub>) from the resist film so as to produce reactants. Such reactants can then deposit on the walls of a resultant resist pattern to increase the aforementioned roughness.

As further described on page 5, line 18 – page 6, line 7 of the specification, Applicant has conceived of a manner to solve the aforementioned problem. For example, by pre-baking *in vacuum*, the reactant gases can be reduced before the exposure step so as to

reduce deposition on the resist pattern. Only Applicant has discovered this problem, and provided a means by which it can be overcome.

The cited prior art is completely silent as to the aforementioned problem when specifically using high energy radiation like EUV during exposure, and therefore provides no motivation for modifying Endo with the pre-baking in vacuum allegedly disclosed in Leveriza. The Examiner's alleged motivation of "removing solvent and enhancing adhesion" derived from Leveriza is attributable to pre-baking generally, not to pre-baking *in vacuum* specifically. Indeed, Leveriza's suggestion of pre-baking to remove solvents is cumulative to the admitted prior art described on page 2, lines 10-11 of Applicant's specification. However, none of the cited prior art suggest the desirability of pre-baking in vacuum specifically when using high energy/short-wavelength radiation like EUV. It should be noted that pre-baking in atmosphere does not adequately remove the aforementioned reactants from the resist film, but is conventionally used only to remove the solvents therefrom as indicated by Leveriza.

Endo is silent as to pre-baking in vacuum and discloses EUV merely as one of plural equivalent options (*see* col. 10, lines 23-26). Endo does not focus on EUV nor recognize the potential problems of using EUV. On the other hand, Leveriza merely discloses pre-baking **generally** "to remove solvent and enhance adhesion" (*see* col. 5, lines 60-61), and does not suggest that pre-baking in vacuum is preferred for any purpose. That is, Leveriza does not suggest pre-baking specifically in vacuum for removing the solvents. In fact, Leveriza expressly discloses that relative to the vacuum/N<sub>2</sub> oven, "[e]quivalent results are obtained by pre-baking ... in a N<sub>2</sub>-atmosphere." Leveriza therefore does not differentiate between pre-baking in vacuum versus in atmosphere.

Leveriza is concerned only with the conventional removal of solvents. Leveriza is silent as to the possibility of reactants which may remain in the resist during conventional pre-baking so as to be released during exposure, thereby leading to the roughness problem discovered by Applicant, and therefore does not suggest the desirability of pre-baking in vacuum over pre-baking in atmosphere.

Accordingly, Leveriza does not provide any motivation or rationale for modifying an atmospheric pre-bake of the prior art with a vacuum pre-bake. Indeed, such a modification can involve a complicated and expensive process, resulting in decreased output and efficiency. It is respectfully submitted that without knowledge of the problem disclosed only in Applicant's specification, one of ordinary skill in the art would not need or desire modifying Endo so as to use the alleged vacuum pre-bake of Leveriza. Rather, such a modification would be undesirable due to the reduced efficiency resulting therefrom and without any known benefit.

The Examiner is directed to MPEP § 2143.01 under the subsection entitled "Fact that References Can Be Combined or Modified is Not Sufficient to Establish *Prima Facie* Obviousness", which sets forth the applicable standard:

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. (*In re Mills*, 16 USPQ2d 1430 (Fed. Cir. 1990)).

In the instant case, even assuming *arguendo* that Endo can be modified by Leveriza, it is submitted that the "mere fact that [Endo and Leveriza] can be combined ... does not render the resultant combination obvious" because nowhere does the prior art "suggest the desirability of the combination" as set forth by the Examiner. None of the cited prior art consider the aforementioned problems associated with using high energy radiation.

Therefore, the cited prior art have no disclosed need or desire for pre-baking in vacuum *as opposed to in atmosphere*. Indeed, as previously mentioned, Leveriza equates vacuum and atmospheric pre-baking so as to teach away from *modifying* Endo.

The Examiner is further directed to MPEP § 2143.01 under the subsection entitled "Fact that the Claimed Invention is Within the Capabilities of One of Ordinary Skill in the Art is Not Sufficient by Itself to Establish *Prima Facie* Obviousness", which sets forth the applicable standard:

A statement that modifications of the prior art to meet the claimed invention would have been [obvious] because the references relied upon teach that all aspects of the claimed invention were *individually* known in the art is *not* sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. (citing *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993)).

In the instant case, even assuming *arguendo* that Endo and Leveriza "teach that all aspects of the claimed invention [are] individually known in the art", it is submitted that such a conclusion "is not sufficient to establish a *prima facie* case of obviousness" because there is no *objective* reason on the record to combine the teachings of the cited prior art.

At best, the Examiner has attempted to show only that the elements (i.e., EUV and pre-baking in vacuum) of the claimed invention are *individually* known without providing a *prima facie* showing of obviousness that the *combination* of elements recited in the claims is known or suggested in the art. For all the foregoing reasons, it is submitted that the proposed combination of Endo and Leveriza is improper, and that the claimed *combination* provides a new and unexpected result over prior art methods.

Even furthermore, it is submitted that the *discovery* of the source of the problem described in Applicant's specification is an additional basis for patentability. The Examiner is directed to MPEP 2141.02 under the heading entitled "Discovering Source/Cause of a Problem is Part of 'As a Whole' Inquiry", which sets forth the applicable standard:

A patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified. (citing *In re Spinnoble*, 160 USPQ 237, 243 (CCPA 1969)).

In the instant case, as noted above, none of the cited prior art recognize or consider the problems associated with using high energy radiation like EUV, let alone conceive of a "remedy" for the particular problem whereby EUV exposure is combined with pre-baking in vacuum.

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 1, 3, 5, 7, 9 and 11 are patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

Based on all the foregoing, it is submitted that claims 1-12 are patentable over the cited prior art. Accordingly, it is respectfully requested that the rejections of claims 1-12 under 35 U.S.C. § 103 be withdrawn.

**CONCLUSION**

Having fully and completely responded to the Office Action, Applicant submits that all of the claims are now in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicant's attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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